tory state in glands and contractile tissues, he brought forward results which were, at the time, entirely novel, and have formed the basis of all subsequent investigations. His paper with Starling on the electrical phenomena of the mammalian heart was the first to give the correct form of the normal variation, as confirmed by later investigations with the string galvanometer.

Another subject which has engaged his attention at intervals during the whole of his career has been the question of the innervation of the blood-vessels. A third group of researches is represented by those on the innervation, intrinsic and extrinsic, of the intestines. A fourth group of papers deals with the mechanism of the pancreatic secretion. These researches, which by themselves would be sufficient to justify the award of the Royal medal, were also carried out in partnership with his colleague, Prof. Starling. The discovery of secretin afforded for the first time a convenient and easy method of obtaining pancreatic juice in large quantities. The investigation of the properties of pancreatic juice and of the activation of its chief proteolytic ferment by another ferment, enterokinase, secreted by the intestinal mucous membrane, has led Bayliss to a further series of researches on the mode of action of enzymes and on the closely related questions with regard to the nature of colloidal solutions. The value of this work has been universally recognised.

DAVY MEDAL.

The Davy medal is this year assigned to Prof. Henry Edward Armstrong, F.R.S., on account of his researches in organic and in general chemistry.

For many years he has been engaged, partly alone and partly in collaboration with many of his students and others, in the investigation of a number of important problems in organic chemistry. His series of memoirs on the terpenes, on the chemical and physical relationships which obtain among the isomerides of the naphthalene and the benzene series, and on physiological chemistry, have established a strong claim for recognition.

In addition to his direct scientific work, he has taken an active part in the discussion and criticism of current theories, and has put forward views on chemical change and on other subjects which have suggested fruitful lines of inquiry. Gifted with a scientific imagination, interested in the work of others, exceptionally well informed as to recent progress, not only in chemistry, but also in cognate sciences, he has had a stimulating effect on his fellow chemists, and has done much to bring together for their mutual benefit the workers in different fields.

HUGHES MEDAL.

The Hughes medal has been assigned to Charles Thomson Rees Wilson, F.R.S., in recognition of the value of his contributions to our knowledge of the nuclei produced in dust-free gases, and of his investigations upon the nature and properties of ions in gases. Following up the well-known work of Aitken on dust nuclei, Mr. Wilson devised a special apparatus for producing a sudden cooling of a gas saturated with water vapour. After completely freeing the gas from dust particles he found that water was condensed on a few nuclei after an expansion of volume greater than 1·25, and that a dense cloud was formed when it exceeded 1·38. This work was in progress at the time of the discovery of X-rays. He immediately tried the effect of passing this radiation through the gas in the expansion chamber, and found that a dense cloud of fine water drops was produced for all expansions greater than 1·25. In this way he showed that the charged ions produced in gases by the X-rays became nuclei for the condensation of water at a definite supersaturation.

This condensation property of ions, discovered by Wilson, was utilised by Sir J. J. Thomson to count the number of ions present, and to determine that fundamental electrical unit, the charge carried by an ion in gases. Recently Mr. Wilson has perfected the expansion method to detect the effects of individual α and β particles.

A further study by this extraordinarily delicate method promises not only to afford a practical means of counting the α and β particles in a gas, but also to throw light upon some of the more important and recondite effects produced by the passage of different types of ionising radiation.

NOTES.

THE Birstall Urban District Council initiated about twelve months ago a movement to commemorate, in his native town of Birstall, the distinguished philosopher and man of science Dr. Joseph Priestley, the discoverer of oxygen. The town of Birstall, which is the birthplace of other distinguished men and women, including Margetson, Primate of Ireland, Curwen, of tonic sol-fa fame, and others, was a fitting birthplace for a man of clear vision, cool thought, and high speculation such as Priestley. Backed by the high Adwalton Moor on the north and north-east, the Priestley homestead of Fieldhead looked out on a fine panorama, with Castle Hill, Huddersfield, and smaller Yorkshire towns rising high on either side of Batley and the stretch beyond. For many years the inhabitants of Birstall have been desirous that something should be done to express by permanent memorial the town's pride in her illustrious son, and the present movement is the outcome. It is proposed to erect a life-size figure of Dr. Priestley on a handsome pedestal, to be placed in the most prominent position in the large market-place. For this purpose 1000*l.* is required, and already about 450*l.* has been secured; but the local committee is now desirous of appealing to a wider public, and especially to all interested in the various branches of chemistry. The London City and Midland Bank, Batley, are the bankers of the "Priestley" Fund.

ON Tuesday, December 5, a deputation of aëroplane and aëromotor manufacturers, with representatives from the Royal Aëro Club and the Aëronautical Society, waited on Colonel Seely in connection with the proposed Military Aëroplane Competition. The deputation, which was introduced by Sir Chas. D. Rose, asked for immediate conditional orders so that manufacturers might have some guarantee of return for the outlay necessary for entering the competition, pointing out that they, representing a struggling and unsupported industry, were asked to compete against flourishing and State-aided industries from abroad in an international competition. Colonel Seely in his reply stated that, with the exception of the principal prize, not all the prizes would be open to the world, and intimated that some orders would be given before the competition. He further said that the answer to the question whether orders would be given for all machines passing the tests would be found in the specification for machines and the rules of the competition, which would be published in about a fortnight's time, and that it was the intention that aëroplanes selected for Government service, which would not be confined to one type, should be manufactured in this country by the civil industry and not in Government factories. He intimated that large orders would be given for the chosen machines, and that if the consensus of the manufacturers' opinion was against holding the competition early in the summer (June) he would see that recommendations to that effect were made in the proper quarter. The deputation subsequently decided to forward a resolution that it would be in the best interests of the competition to postpone it until September.

AN interesting demonstration in connection with electro-chemical culture will be given on Saturday, December 9, at 4 o'clock, at the Royal Botanic Society's Gardens in Regent's Park, when practical demonstrations will be made with an electric apparatus to show the effect of electricity on the germination of seeds.

THE Physical Society's annual exhibition, which is to be held on Tuesday, December 19, at the Imperial College of Science, South Kensington, will be open in both the afternoon (from 3 to 6 p.m.) and in the evening (from 7 to 10 p.m.). The Hon. R. J. Strutt, F.R.S., will give a discourse at 4.30, and again at 8 p.m., on "Electric Discharge and the Luminosity which survives it." About thirty firms will exhibit apparatus.

We regret to see announced the death, on November 23, of Mr. Arthur Cottam, at seventy-five years of age. Employed as an official in a Government department during a great part of his life, he was an enthusiastic amateur astronomer. He was elected a fellow of the Royal Astronomical Society so far back as 1862, and was one of the original members of the British Astronomical Association, being its secretary from its foundation in 1890 to 1892, when he resigned owing to increasing pressure of official duties. In 1898 he became director of the Jupiter section of the association, an office which he retained until 1903. Mr. Cottam is best known by an excellent star atlas, "Charts of the Constellations," which he published in 1889. These charts show all stars down to about the 6·5 magnitude, from the North Pole to between 35° and 40° of south declination, for the epoch 1890. Originally projected as companions to Webb's "Celestial Objects" and Smyth's "Bedford Catalogue," their scope was considerably enlarged, and they show many original features. Each map usually gives one constellation only with the region around it, and the brighter stars have much larger discs than usually given, so that the leading stars in the maps are those which catch the eye by their brightness in the heavens.

In *Die-Woche* of November 25 we find an article on the Middle European earthquake of November 16. It describes the districts which were most disturbed, the one most strongly shaken being that of the northern Alps. The central earthquake station in Strassburg places the origin to the south-east of Lake Constance. From time observations the epicentral area lies in 47 degrees north latitude and 10·30 east longitude. But before anything definite can be said as to this and other matters connected with earthquake, it is necessary to wait for reports from other stations. In the article reference is made to the geological character of the northern Alps and the Rhine Valley, the numerous faults which occur, and the relationship of these to tectonic earthquakes.

Prof. W. C. **Brögger** (Christiania), Geh. Rath Prof. T. Curtius (Berlin), Prof. P. A. Guye (Geneva), and Geh. Regiersrung Rath Prof. H. Rubens (Berlin), have been elected honorary members of the Royal Institution. Dr. W. Bateson, F.R.S., has been appointed Fullerian professor of physiology for a term of three years. At a meeting of the managers of the institution on December 4 the following resolution was passed unanimously:—"That the managers offer their special thanks to the Fullerian professor of chemistry for his munificent gift to the institution in the decoration and furnishing of the lecture room, and at the same time they wish to express their high appreciation of the occasion upon which it has been made, namely, in commemoration of his having, on October 22, 1911, occupied the chair of chemistry as long as it was held by Faraday."

The following are among the lecture arrangements at the Royal Institution before Easter:—Dr. P. Chalmers Mitchell, a Christmas course of six illustrated lectures on the childhood of animals, adapted to a juvenile auditory: (1) "Introductory"; (2) "The Duration of Youth"; (3) "Colours and Patterns of Young Animals"; (4) "Young Animals at Home"; (5) "The Feeding of Young Animals"; (6) "The Play of Young Animals." Dr. W. Bateson, six lectures on the study of genetics; Prof. E. G. Coker, two lectures on optical determination of stress and some applications to engineering problems; Dr. T. Rice Holmes, three lectures on ancient Britain; Prof. A. W. Bickerton, two lectures on the new astronomy; Prof. A. M. Worthington, two experimentally illustrated lectures on the phenomena of splashes; Mr. F. A. Dixey, two lectures on dimorphism in butterflies: (1) "Seasonal Dimorphism," (2) "Sexual Dimorphism"; the Rev. John Roscoe, two lectures on the Banyoro: a pastoral people of Uganda: (1) "The Milk Customs," (2) "Birth and Death Customs"; Sir J. J. Thomson, six lectures on molecular physics. The Friday evening meetings will commence on January 19, when Sir James Dewar will deliver a discourse on heat problems. Succeeding discourses will probably be given by Prof. Bertram Hopkinson, Dr. J. Mackenzie Davidson, Dr. J. A. Harker, the Rt. Hon. Sir John H. A. MacDonald, Mr. G. K. B. Elphinstone, Dr. W. J. S. Lockyer, Mr. F. Soddy, Prof. D'Arcy W. Thompson, Sir J. J. Thomson, and other gentlemen.

The Lord Mayor will preside at the sixth annual meeting of the National League for Physical Education and Improvement, to be held at the Mansion House to-morrow, December 8, at 3.30 p.m. The meeting will be addressed by Sir Archibald Geikie, president of the Royal Society; the Lady St. Davids; Dr. Christopher Addison, M.P. (on legislation and public health); Prof. Bostock Hill, county medical officer of health for Warwickshire (on the organisation of a National Health Week); Mr. Henry Jephson, and others. Among those who have promised to attend are Sir Lauder Brunton, Sir John Tweedy, Sir Wiliam Church, Sir Edward Brabrook, Muriel Viscountess Helmsley, Lieut.-General Sir Robert Baden-Powell, Admiral the Hon. Sir E. Fremantle, and Archdeacon Sinclair.

A special weights and measures committee of the Central Chamber of Agriculture recommended recently that agricultural produce should be sold by weight. It reported that suitable weights were the lb., the cental (100 lb.), and the short ton of 2000 lb. Dealing with this suggestion in a circular, which has been distributed, the Decimal Association points out that advocates of the metric system offer a solution of the difficulty by proposing that farmers should urge the compulsory introduction of the metric system into this country. Less disturbance would result from the adoption of the metric system than would follow the introduction of the cental and short ton, for the reason that the larger measures of the metric system differ but little from the cwt. and ton. The increase of the lb. by about 10 per cent. to make it equal to the half-kilo would lead to a metric cental of 110 lb. (100 metric pounds), and a ton of 2000 metric pounds equal to 2204 present lbs. Our Consul at Copenhagen reports that the Metric System Act, which will come into force next April, was passed by the Danish Upper and Lower Houses, in both of which the majority are agriculturists.

By the authority of the Dominion Government, the director of the Canadian Meteorological Service has established a department of physics in connection with the Central Office at Toronto. Mr. John Patterson has been placed in charge of this new department; and it is proposed to carry on research work in atmospheric electricity, solar radiation, ionisation, and the exploration of the upper atmosphere. A kite station has been equipped near the magnetic observatory some fourteen miles from Toronto, and good results are being obtained. Since February last registering balloons carrying the Dines meteorograph have been sent off with regularity on the international days, and of sixteen balloons liberated, eight have been returned to the Central Office with good records. In comparison with the results obtained in Europe, the percentage of successful ascents may be regarded as very encouraging. The heights reached have varied from 11·2 to 23·2 kilometres. The isothermal layer has been found at an average height of 13 kilometres. The lowest temperature recorded was −70° C. at 15 kilometres on July 5, and the highest altitude reached was 23·2 kilometres on September 9, when the lowest temperature, −55·5° C., was recorded at 14 kilometres.

THE premises of the Institute of Chemistry, the lease of which will expire shortly, and cannot be renewed, have become inadequate for the increasing activities of the institute. To carry on the work, the council of the institute requires new buildings, which should include more commodious meeting rooms, library, laboratories, examination rooms, and offices. It is proposed to begin the preparation of plans next year, and it is estimated that the necessary building and fittings will cost about 15,000*l*. An appeal has been made to fellows and associates of the institute, which has already resulted in the receipt of contributions and promises amounting to more than 8000*l*. With more than half of the required sum assured, it may be confidently hoped that the appeal will result in the completion of the necessary amount at an early date. It is gratifying to notice that the preliminary list of contributions includes the names of some of the great city companies and of business firms not directly connected with the institute. Contributions may be forwarded to the president, Dr. G. T. Beilby, F.R.S., at 30 Bloomsbury Square, London, W.C., or may be sent direct to the account of the Institute of Chemistry (Buildings Fund) with the London County and Westminster Bank, 214 High Holborn, London, W.C.

THE annual meeting of the American Association for the Advancement of Science will be held this year in Washington on December 27–30. The retiring president, Dr. A. A. Michelson, will, on the evening of December 27, introduce the new president, Dr. C. E. Bessey, of the University of Nebraska, and afterwards deliver his address on "Recent Progress in Spectroscopic Methods." On December 27 the presidential addresses in the sections will be:—the resins and their chemical relations to the terpenes, Mr. Frankforter; adaptation, Mr. Reighard; some current conceptions of the germ plasm, Mr. Harper. On December 28:—work of the electrical division of the Bureau of Standards, Mr. Rosa; aërial engineering, Mr. Rotch; the teaching of general courses in science, Mr. Hill. On December 29:—on the foundations of the theory of linear integral equations, Mr. Moore; the independence of the culture of the American Indian, Mr. Dixon; the cause of high prices, Mr. Burton. The presidents of the sections for the ensuing year are as follows:—A, Mathematics and Astronomy, E. B. Frost, Yerkes Observatory; B, Physics, R. A. Millikan, University of Chicago; C, Chemistry, F. K. Cameron, U.S. Department of Agriculture, Washington, D.C.; D, Mechanical Science and Engineering, C. S. Howe, Case School of Applied Science, Cleveland, Ohio; E, Geology and Geography, B. Shimek, State University of Iowa; F, Zoology, H. F. Nachtrieb, University of Minnesota; G, Botany, F. C. Newcombe, University of Michigan; H, Anthropology and Psychology, G. T. Ladd, Yale University; I, Social and Economic Science, J. Pease Norton, Yale University; K, Physiology and Experimental Medicine, W. T. Porter, Harvard Medical School, Boston; L, Education, E. L. Thorndike, Columbia University. Thirty scientific and other learned societies have indicated their intention to meet at Washington on the same dates in affiliation with the American Association for the Advancement of Science. The permanent secretary of the association is Dr. L. O. Howard, Smithsonian Institution, Washington, D.C.

THE twentieth report of the Board of Health on Leprosy in New South Wales for the year 1910 (dated July 31, 1911) states that nineteen lepers remained under detention at the lazaret, and that five new cases were reported in 1910. The histories of these new cases are detailed, together with surveys of the white patients remaining under treatment. Nine excellent plates of the condition of some of the lepers are appended.

IN *The Quarterly Journal of Experimental Physiology* for October (iv., No. 3) Messrs. Vernon and Stolz discuss the influence of forced breathing and of oxygen on athletic performance. It is well known that several deep inspirations enable the breath to be held for a longer period than without this preliminary, but it is shown that to obtain this result the forced breathing should be continued for two or three minutes. An addition of oxygen much lengthens the period during which the breath can be held. Thus Mr. Vernon found that after six minutes of forced breathing of air, followed by four breaths of oxygen, he could hold his breath for no less than 8m. 13s.

IN *Himmel und Erde* for November (Jahrg. 24, Heft 2) Dr. E. W. Schmidt, under the title of "Die Panspermie-Hypothese," gives an account of the views of Arrhenius on the possible transference of living germs through interstellar space from one star or planet to another; Prof. Ficker continues his series of articles on bacteria as enemies and friends of man; and Dr. Emil Carthaus discusses the origin of pearls, and gives many interesting historical details concerning them.

IN a recently published pamphlet entitled "The Fight against Tuberculosis and the Death-rate from Phthisis" (Dulau and Co., pp. 35, price 1*s*. net), Prof. Karl Pearson criticises the evidence which has been advanced in favour of a belief that the prevalence of phthisis can be, or has been, diminished by measures intended to reduce the opportunities of infection. Prof. Pearson strongly urges the importance of some constitutional factor, and publishes diagrams which, in his opinion, render it difficult to suppose that the fall in the phthisis death-rate which has been observed in modern times can be attributed to increased segregation of the diseased, bettered environment, or changes in treatment. The pamphlet will repay perusal, although its style, which is more vigorous than urbane, is not likely to facilitate an impartial consideration of Prof. Pearson's views.

THE report of the Manchester Museum for 1910–11 contains plans and a view of the front elevation of the proposed new wing, part of which is now in course of construction, while the remainder is reserved for the future. It appears that in the original scheme for the natural history museum Egyptology and anthropology were not included; but during the last thirty years large collections in these subjects have accumulated, which require adequate accommodation, and it is for these that the new building is being erected. The cost of the whole scheme of extension is estimated at 10,000*l*., of which 5000*l*. has been given by Mr. Jesse Haworth, while 2825*l*. has been raised by public subscription. The general progress of the museum has been very satisfactory during the year, and the attendance at the courses of lectures fairly good.

In the second part of the Transactions of the Bristol and Gloucestershire Archæological Society Miss M. L. Bazeley contributes an important paper on the relations of the Forest of Dean with the Crown during the twelfth and thirteenth centuries. She describes in detail the ancient boundaries of the forest, the animals found in it, and the periodical Royal visits for the purpose of sport. Fallow deer were abundant, with red deer and roes in smaller numbers. Wild boars seem to have been exceedingly numerous. On one occasion King John had twenty captured for use on the Feast of St. David at Westminster; twenty boars and sixty sows were sent to him for the Feast of the Nativity, and Henry III. had as many as a hundred for the Christmas dinner in 1254. These requisitions seem to have seriously reduced the supply. We hear of hunts of wolves and wild cats in 1281, when of the former we are told that they "as injurers of the venison frequently return for the venison and stay in the said wood, on account of the thickness thereof."

The report of the Marine Biological Association of the West of Scotland for 1910 indicates that the work of that body has been carried on steadily during the period under review; and it may be noted that a special effort has been made to provide, in full efficiency, all the facilities for study and research available at Millport. A large number of visitors entered the museum and aquarium, the latter of which is steadily increasing in popularity.

In the November issue of *The Zoologist* Dr. James Murie discusses the introduction of the American slipper-limpet (*Crepidula fornicata*) into this country, and its influence on oyster-culture in Kent and Essex. The mollusc appears to have been introduced into the estuary of the Crouch and other rivers on imported American oysters somewhere about 1880, and by 1893 had become comparatively abundant; it is now too firmly established to be eradicated. Its introduction has entailed considerable extra labour on oyster-beds, as the oysters have from time to time to be dredged and freed from the parasite, which adheres tightly to their shells. But this is not all, as this constant and excessive dredging causes the growing oysters to have broken or imperfectly formed margins to their valves, whereby their commercial value is lowered. Investigations with the view of mitigating the evil appear to be urgently required.

In connection with the letter from Messrs. Puran Singh and S. Maulik in Nature of November 23 on the nature of the light from fireflies, it may be mentioned that the subject has been recently discussed in vol. iii., No. 1, of the Annals of the Transvaal Museum by Mrs. A. B. Howard, who observes that this light is unique in being unaccompanied by perceptible heat, and is therefore produced at the least possible expenditure of energy. In the American species, on which the investigations were made, light is emitted by both sexes, although that of the flightless female is feebler than that of her partner. In the latter the light is produced by a pair of plates lying beneath the thin skin and filling the lower half of the fourth and fifth abdominal segments. These light-giving organs consist of an upper and a lower layer, of which the latter is composed of polygonal cells filled with coarse granules. Although the minute size of the structures renders investigation very difficult, it is considered probable that the light is due to the oxidation of some substance—very likely fatty—contained in the cells of the lower layer of the light-organs.

As those who have studied the subject are aware, there are features connected with "fairy rings" which are not immediately explicable. In the latest paper, which appears in *The Journal of Economic Biology* (vol. vi., No. 4), Miss J. S. Bayliss points out that it is not known how the fungus first infects the soil or why it grows in rings; but otherwise the paper provides acceptable explanations of observed features and experiments in connection with the ring growth of *Marasmius oreades.* Two zones are easily recognised, an inner dark green grass zone and a dead grass zone where the fungus is growing. Dr. Bayliss directs attention to another dark green zone on the outside that is particularly well developed in September. The action of the fungus is complicated, since it apparently produces a stimulating effect, as shown by the outer green zone, while it excretes a toxic substance leading to the complete destruction of the grass; subsequently it poisons the ground for its own development, and then decomposes into manure for the grass.

During the past few years various expeditions from the University of Chicago have secured from the fossil fields of northern Texas the largest and best collection of Permian vertebrate fossils in the world. During last summer an expedition from the University, under the direction of Prof. S. W. Williston, explored the Permian deposits of north-western New Mexico with valuable results. *Science* says that these Permian deposits, of small extent, in Rio Arriba County, were discovered more than thirty years ago, but have been neglected by explorers ever since, and their precise location even was unknown to geologists. As a result of Prof. Williston's excavations, numerous fossils have been shipped to the University, many of which are unknown to science. This collection includes six or seven new genera of reptiles and amphibians, one of which is represented by one of the most perfect skeletons, about 6 feet in length, ever found in any deposit in America.

To *Symons's Meteorological Magazine* for November Mr. F. W. Henkel contributes an interesting article entitled "Is the Zodiacal Light a Meteorological Phenomenon?" The author points out that a complete and satisfactory answer to the question cannot be given, and that our knowledge of the subject is but little greater than was possessed by the first discoverers. Even in recent times considerable confusion has existed between the phenomenon and the aurora. He refers to the various observations made since the time of Cassini, of Paris (about 1683), and to the descriptions of the counter-glow (at an angular distance of 180° from the sun) by Brorsen and others. One of the most recent theories of the latter phenomenon is that suggested by Mr. Innes in Nature of June 16, 1910.

The Weekly Weather Report issued by the Meteorological Office gives a summary of the temperature, rainfall, and bright sunshine for the several districts of the United Kingdom for the thirteen weeks ended December 2, which embraces the whole period of autumn. The mean temperature was generally below the average in Scotland, it was in good agreement with the average in Ireland, whilst in England an excess of temperature occurred for the most part. The range of temperature was unusually large, due chiefly to the exceptional heat in the recent abnormal summer, which was prolonged into the early autumn. In the Midland counties the range was 69°, from 94° to 25°, and in the south-west of England it was 71°, from 91° to 20°. The autumn rains have varied considerably in different parts of the kingdom; they were in excess of the average over the eastern portion of Great Britain, in the north-west of England, the south of Ireland, and in the English Channel. The least aggregate autumn rainfall is 6·88 inches, in the Midland counties, which is 0·48 inch below the normal; whilst in the south-east of England the aggregate fall is 10·47 inches, which is 1·98 inches more than the average. The absolutely largest rain measurement is 13·78 inches, in the north of Scotland, which, however, is 1·82 inches less than the normal. The number of rainy days are nowhere very different from the average, the greatest number being fifty-eight days, in the north of Scotland and in the south of Ireland; the least forty-seven days, in the south-east of England. The duration of bright sunshine was in excess of the average over the entire kingdom, except in the English Channel. The greatest duration is 382 hours, in the south-east of England, which is sixty-nine hours more than usual.

MR. M. A. HUNTER, of the electrical engineering department of the Rensselaer Polytechnic, Troy, has succeeded in producing metallic titanium in a state of purity greater than has been hitherto possible. He uses the method of Nilson and Petersson, *i.e.* reduces the tetrachloride of titanium by heating it with metallic sodium in an airtight steel bomb capable of withstanding an internal pressure of more than 5000 atmospheres. With a charge of 500 grams of the tetrachloride and 245 grams of sodium, after heating the bomb to redness to start the reaction and then allowing it to cool, he obtained 71 grams of molten metal, 31·5 of coarse and 4·5 of fine powder, as against a theoretical yield of 126 grams. Analysis of the product appears to indicate that the molten material is pure titanium. Messrs. Hunter and Jones find that the density of the metal is 4·50, and its specific heat between 0° C. and 100° C. is 0·1462.

VOL. iv. of the Journal of the Municipal School of Technology, Manchester, a record of the investigations carried out by the staff and students, and published in the technical Press or the Proceedings of scientific societies during the year 1910, is not so bulky as its immediate predecessors, although it runs to 250 pages. The papers reprinted are, on the whole, short, and they deal principally with the applications of electricity in engineering or of chemistry in textile processes. Of the longer papers, those of Prof. Schwartz and his staff on the physical and electrical properties of indiarubber and on the field of the polyphase motor may be mentioned. In an important paper by Prof. Haldane Gee and Mr. Harrison, reprinted from the Transactions of the Faraday Society, the authors bring forward weighty experimental evidence in favour of the electrical theory of dyeing. According to this theory, a basic dye is positively, and an acid dye negatively, charged, and the processes through which the fabric passes before it is brought into the dye are such as to charge it negatively or positively respectively, so that there may be electrical attraction between dye and fabric. The number of "laws of dyeing" which the electrical theory places on a firm scientific basis is remarkable.

AMONG primary plant materials, the pentosans, so widely diffused, form a class of substances the origin and function of which are still uncertain in spite of numerous researches which have been made to throw light on these problems. An interesting contribution to the question is found in a paper by Ciro Ravenna in the *Gazzetta Chimica Italiana* (vol. xli., p. 115). It is shown as the result of a large number of experiments, in which the pentosans were estimated in the very young, primary leaves of the beech and of *Vicia faba minor*, at dawn and sunset, that no marked variation in their amount can be traced during the period of chlorophyllian activity; but at night considerable but irregular variations occur, generally in the direction of increase, but sometimes in that of decrease. When, however, the stalk of the growing leaf is immersed in a nutritive solution containing 2 per cent. of dextrose, and the plant allowed to continue its growth for several days exposed to sunlight in an atmosphere free from carbon dioxide, the proportion of pentosans is very largely increased, being often nearly doubled. A similar, but not so well marked, result was obtained in experiments in which the plant continued its growth in the nutritive solution in darkness, but in an atmosphere containing the ordinary proportion of carbon dioxide. It is contended that the pentosans are elaborated, not from the complex polysaccharides, such as starch and cellulose, by down-grade changes, as is generally supposed, but that they are formed direct from the simple carbohydrates. It is also shown that when the chlorophyllian activity is inhibited, the pentosans diminish in relative amount, so that it would appear that, in addition to their other functions, they are capable also of acting as reserve material for the plant.

A PROPOSAL for the reform of income tax and estate duty is put forward by Mr. Douglas White in *The Economic Journal*, xxi. 83. According to the author's proposed system, the rate per pound at which an income would be taxed would be proportional to the logarithm of the income, so that as incomes increased in geometric progression the rate of the tax would increase in arithmetical progression. If, as Mr. White proposes, this system were carried out rigorously with the use of logarithm tables, it would certainly, as alleged, remove the discontinuities of the present system, where what a man pays is regulated largely by whether his income falls on a lucky number such as 499*l.*, or an unlucky one such as 501*l.* In practice it would be sure to be simplified by retaining these discontinuities, for which a much simpler, obvious remedy is possible.

A PAPER on the design of tall chimneys was read by Mr. Henry Adams before the Society of Engineers on December 4. Tall chimneys ought to be designed upon scientific principles so that there is an absolute guarantee for their stability. The object of Mr. Adams's paper was to elucidate these principles and apply them to practice. There are several rules for determining the height of a tall chimney; in some towns 45 feet may be sufficient, but in others 90 feet is the minimum allowed. The height may be determined from the amount of coal burnt, or from the length of boiler and flues. Four different rules were given for the sectional area, depending upon the amount of coal burnt per hour, the fire-grate area, the horse-power of the engine, or a combination of these with the height of the chimney. The shape may be square, octagonal, or circular, the effective wind pressure varying in each case. The author's formula for wind pressure takes account of height and width, increasing with the distance from the ground and increasing also with reduced width. Eight authorities were quoted for the coefficient of pressure for a circular shaft varying from 0·5 to 0·7854. The thickness of the brickwork varies 4½ inches every 20 feet in height, but the top length will be from one to one and a half bricks thick, according to the height and diameter. The over-all width at base must be at least one-tenth, and if circular at least one-twelfth, of the total height. After the section is drawn out to suit the conditions, the stability should be calculated at each set-off. The principles of stability can be illustrated by considering a solid square brick pier.

MR. LIVINGSTONE SULMAN, president of the Institution of Mining and Metallurgy, delivered an address at the annual prize distribution of the Sir John Cass Technical

Institute on November 29. In the course of his address Mr. Sulman pointed out that the dominant thought which impressed one to-day was the many-sidedness, the increasing scope, and the intense vigour which now marks metallurgical progress. The interaction of associated sciences is now beginning to play its part in the development of metallurgical industries. Certain of the factors of so-called molecular energy find expression in some of the newer processes and phenomena of metallurgy, as shown in the methods adopted to the harnessing of molecular attractions which reside upon the surfaces of solids, to the purposes of ore concentration. These methods, which have, for example, completely changed the economic outlook of the great Broken Hill deposits of silver-lead-zinc ores, are there used to separate the blends constituent in saleable form from the "tailings" left behind after the bulk of the lead and silver have been recovered. But they are applicable, in general, to all sulphide ores, as well as to finely divided metals and non-metals, such as gold, graphite, carbon, diamond, sulphur, and so on; and they are frequently spoken of as "oil processes," from the fact that in several of them oil is used in larger or smaller quantities, usually in smaller. In such processes there are no chemical reactions to speak of; physical forces of previously unsuspected range and power, so far as commercial applications are concerned, have been induced to do the work more easily and much more economically, the force mainly concerned being what is called "surface energy." Equally new, and probably of great importance to the metallurgist of the future, are the developments in colloidal chemistry. The plasticity of clays and "ultrasliminess" of "slimes" are due to this class of bodies, in which inorganic materials ape the reactions of organic; a clay colloid may almost be said to masquerade as a fatty acid. Mr. Sulman also referred to the extended application of improved magnetic and electrostatic methods for the separation of dry ores, and to catalytic processes of metallurgical importance.

A selected "List of Educational Books for Schools, Colleges, and Self-tuition," issued by Messrs. W. and G. Foyle, 135 Charing Cross Road, London, W.C., has reached us. Nearly all the books included in the catalogue can be supplied secondhand at half the published prices; and Messrs. Foyle will send any book in stock on approval.

Messrs. William Wesley and Son, 28 Essex Street, London, W.C., have sent us a copy of the latest issue of their "Natural History and Scientific Book Circular." It contains a catalogue of 356 selected books on natural history, with coloured illustrations, followed by a list of works published by, or on sale with, Messrs. Wesley and Son, who are, it may be added, agents for the Smithsonian Institution and the U.S. Government departments.

Messrs. J. Wheldon and Co. (38 Great Queen Street, Kingsway, W.C.) have just issued a supplement to their scientific and geological catalogues. The supplement comprises recent purchases in astronomy, chemistry, geology, palæontology, mineralogy, mining, &c., and includes a small collection of works on applied chemistry, metallurgy, and other subjects.

Erratum.—We are asked to state that in the abstract of Mr. Hutchinson's paper read before the Mineralogical Society (p. 165) the temperature at which gypsum becomes optically uniaxial should be 95° C., not 25° C. The incorrect value was given in the typewritten report received by us, and the error was not corrected in the proof submitted and returned to the printers.

OUR ASTRONOMICAL COLUMN.

Discovery of a New Comet, 1911*h*.—A telegram from Kiel announces the discovery of a new comet by M. Schaumasse, at Nice, on November 30. Its position at 17h. 15·9m. (Nice M.T.) was

R.A. = 13h. 12·2m., dec. = 5° 51′ N.,

and its daily motion was found to be +3m. 32s. in R.A. and −13′ in declination; the magnitude is 12·0.

A second telegram gives an observation by Dr. Abetti at Arcetri on December 2, the position at 17h. 26·9m. (Arcetri M.T.) being

R.A. = 13h. 19m. 17·6s., dec. = 5° 24′ 29″ N.

The comet is thus seen to be moving in a south-east direction through Virgo.

Borrelly's Comet, 1911*e*.—Borelly's comet, rediscovered by Mr. Knox Shaw on September 19, is approaching both the sun and the earth. As the perihelion passage will take place on December 18, when the comet is nearly in opposition with the sun, and as the comet is moving northwards rapidly, it may become visible with opera-glasses during the latter part of December and in January, 1912 (*L'Astronomie*, November).

The Production of Star Streams.—A paper by Prof. Benjamin Boss, in No. 629 of *The Astronomical Journal*, discusses, in relation to a star stream he has found among seventy-one large proper-motion stars given in the Preliminary General Catalogue, the somewhat startling suggestion that community of direction and velocity in such streams may be caused by the initiation and maintenance of their motions in an electromagnetic field of universal extent.

The directions and proper motions of eleven of these large proper-motion stars, together with their radial velocities and parallaxes where available, agree so well as to preclude the idea of chance occurrence, and some physical explanation is sought.

Assuming that the stars form from nebulæ, the motion of the latter might explain the phenomena; but the extended nebulæ do not exhibit such *motus peculiaris*, and Prof. Boss seeks the common cause elsewhere.

The suggestion is that the nebulæ are the seat of tremendous ionisation forces producing segregation, and electromagnetic polarities in the segregated masses. In the course of time a relatively strongly polarised mass becomes expelled from the matrix and commences a stellar existence. Initially the directions would be haphazard, but the action of the supposed universally existent electromagnetic field would be to swing the polarised masses into paths along the approximately parallel lines of force. Assuming the B-type stars to be the newest, Prof. Boss finds support in the fact that such stars display random motions, while those in his group of large proper-motion stars, exhibiting community of direction, are of the types F, G, and K. Further, the action of a constant acceleration such as is suggested would tend to level up the differences found in the initial velocities, thus producing the community of velocity observed.

Double-star Measures.—In No. 4534 of the *Astronomische Nachrichten* Prof. Burnham publishes a long list of recent measures of double stars related largely to the proper motion of stellar systems contained in his General Catalogue. The measures were made with the 40-inch refractor at the Yerkes Observatory, and follow on Prof. Burnham's similar publications in the same journal.

In No. 4537 Herr J. Voûte publishes a second list of double-star measures, which will later be published *in extenso* in the Annals of Leyden Observatory.

Radial Velocity of α Cygni.—Some time ago we directed attention to a result obtained by Prof. Belopolsky and Mr. Neuimin in which they found what appeared to be a real difference between the radial velocity of α Cygni as determined from the metallic lines and that determined from the hydrogen and helium lines. At the suggestion of Prof. Frost, Mr. O. J. Lee has examined some measures of the spectrum made by him in 1910, and he fails to find any confirmation of the Pulkowa results. He suggests that the discrepancy found by Neuimin and Belopolsky